S.C. Department of Health and Environmental Control

Proposed Plan for Site Remediation

Former Starmet CMI Facility

365 Metal Drive, Barnwell, South Carolina

January 2017

ANNOUNCEMENT OF PROPOSED PLAN

The South Carolina Department of Health and Environmental Control (DHEC or the Department) has completed an evaluation of cleanup alternatives to address contamination at the former Starmet CMI Inc. (Starmet) Facility, previously known as Carolina Metals, Inc. (the Site). This Proposed Plan identifies DHEC's Preferred Alternative for cleaning up the contaminated areas and provides the reasoning for this preference. In addition, this Proposed Plan includes summaries of the other cleanup alternatives evaluated. These alternatives were identified based on information gathered during environmental investigations conducted at the Site since 2002.

The Department is presenting this Proposed Plan to inform the public of our activities, gain public input, and fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP). This Proposed Plan summarizes information that can be found in greater detail in the Evaluation of Remedial Options Report (February 2008), the Revised Decommissioning Cost Estimate Report (May 2014), and other documents contained in the Administrative Record file. The Department encourages the public to review these documents to gain an understanding of the Site and the activities that have been completed.

The Department will select a final cleanup remedy after reviewing and considering comments submitted during the 30-day public comment period. The Department may modify the Preferred Alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

DHEC's Preferred Cleanup Summary
Alternative 3: Release for Unrestricted Use

DHEC's preferred remedial option includes:

- Decontamination of the DU Building for future use without restrictions;
- Demolition and complete removal of the R&C Building and its contents, including the attached office building;
- Remediation of uranium contaminated soil from various locations across the Site;
- Off-site disposal of all contaminated materials at an appropriately-licensed facility; and
- Demonstration that applicable release limits (concentrations) have been met by conducting a final comprehensive radiological survey.

MARK YOUR CALENDAR

❑ PUBLIC MEETING:

When: Thursday, January 26, 2017, at 6:30 pm

Where: Barnwell County Public Library
40 Burr Street
Barnwell, SC

DHEC will hold a meeting to explain the Proposed Plan and all alternatives presented in the Evaluation of Remedial Options report. After the Proposed Plan presentation, DHEC will respond to your questions. Oral and written comments will be accepted at the meeting.

❑ PUBLIC COMMENT PERIOD:

January 26, 2017 through February 27, 2017

DHEC will accept written comments on the Proposed Plan during the public comment period. Please submit your written comments to:

Angie Jones, Project Manager
SC DHEC Bureau of Land & Waste Management
2600 Bull Street
Columbia, SC 29201
jonesar@dhec.sc.gov

❑ FOR MORE INFORMATION:

Call: Angie Jones, Project Manager, 803-898-0769

See: DHEC's website at:
www.scdhec.gov/publicnotices

View: The Administrative Record at the following locations:

Barnwell County Public Library
40 Burr Street, Barnwell, SC
Hours: Monday - Wednesday 10 am - 6 pm
Thursday 10 am - 9 pm
Friday 10 am - 6 pm
Saturday 10 am - 2 pm
Sunday CLOSED

DHEC Freedom of Information Office
2600 Bull Street, Columbia, SC
(803) 898-3817
Monday - Friday: 8:30 am - 5:00 pm

SITE HISTORY

The Site is located on a 320-acre parcel at 365 Metal Drive, in a sparsely populated, rural area, approximately 6.3 miles southwest of Barnwell, South Carolina. The area surrounding the Site is a mix of industrial properties, agricultural parcels, and undeveloped land. The Site is bordered to the north and northeast by Gantts Mill Creek and undeveloped land. To the west, the Site is bordered by Lower Three Runs Creek. Both Gantts Mill and Lower Three Runs Creek are currently the property boundary for the Savannah River Site. To the east are Poplar Road, agricultural parcels, and undeveloped land. The Site is bordered to the south by Lyndhurst Road, as well as agricultural and undeveloped land. On the parcel are two main structures that consist of the Reduction and Conversion Building (R&C Building) and the Depleted Uranium Technology Recycling Center (DU Building). Former Evaporation Ponds are located approximately 100 feet south of the DU Building.

The former Starmet facility was built in 1982 and operated for approximately 19 years. When the facility was active, the processes performed included the reclamation of uranium scrap, conversion of uranium hexafluoride (UF_6) to uranium tetrafluoride (UF_4), production of uranium oxide aggregate and depleted uranium metal, and re-plating of uranium metal counterweights used in the aircraft industry.

Routine site inspection reports beginning in July 2000 documented multiple violations of the facility's Atomic Energy and Radiation Control Act license (issued by the Department) and other Department regulations. By June 2001, Starmet and the Department executed a Consent Order relating to the violations observed in July 2000. In September 2001, the Department placed a moratorium on Starmet to prohibit the receipt of any radioactive material. Starmet then filed a voluntary petition for bankruptcy on March 26, 2002, pursuant to Chapter 11 of the United States Bankruptcy Code. On June 25, 2002, the Department issued an Emergency and Administrative Order to Starmet which required the facility to cease operations.

It had been determined the Site posed an imminent threat to public health and the environment for the following reasons:

- Two compromised retention ponds containing approximately 550,000 gallons of uranium contaminated wastewater with concentrations in excess of 250,000 picocuries per liter (pCi/L), compared to a maximum release standard of 300 pCi/L;
- Approximately 18,000 drums of radioactive material stored without the operation of the facility's ventilation and fire suppression systems;
- Drums of pyrophoric uranium metal shavings stored improperly;
- Vats of plating acids stored improperly;
- Radiation dose readings at the property boundary in excess of regulatory limits for public exposure; and
- Significant radiation doses emanating from metals believed to be decommissioned parts of commercial reactors.

DHEC immediately referred the Site to the United States Environmental Protection Agency (EPA). The following month an emergency removal action was initiated by the EPA's Emergency Response and Removal Branch (ERRB) to prevent the release of depleted uranium from the compromised retention ponds behind the facility and to mitigate other risks posed by the large quantities of hazardous materials stored improperly on-Site.

The EPA's removal action was completed four years later in July 2006. Since that time, the Site has been under the control of the Department. A Radiation Safety Officer currently remains onsite for the Department and performs necessary operation and maintenance activities.

AREAS OF CONCERN

The major facility features of environmental significance include the following:

Reduction and Conversion Building (R&C Building) – This building is located closest to the entrance of the facility and contains the administration area or main office.

Due to the age and past use of this building, the entire structure is highly contaminated. Most of the uranium processing equipment, still housed in this building, is contaminated with uranium. Inspections conducted as recent as January 2015 to assess the current structural integrity indicate all building support structures continue to degrade

as humidity and leaks from failing ceiling panels reanimate *"plated out"* acids and redeposit radioactive material on the floor and other surfaces. The level of visible corrosion on load bearing trusses and support brackets is becoming more apparent with each Department inspection.

Depleted Uranium (DU) Recycling Technology Center (DU Building) – This building was constructed in 1992, after the plant had operated for more than ten years, to store depleted uranium and other wastes that had accumulated. The DU Building also contained the facility's aircraft counterweight re-plating area. This building lies to the northwest of the R&C Building.

When the facility was ordered to cease operations, thousands of drums were found to be improperly stored in this building. The drums contained dispersible radioactive powder, weighed between 1,600 and 2,000 pounds, and were stacked three-high. Many of the drums had deteriorated from excessive weight, the pressure of other stacked drums above them, and chemical corrosion. Some drums had failed and uranium contaminated substances had spilled onto the floor. All drums were removed during the EPA emergency removal action; however, residual contamination remains in the building.

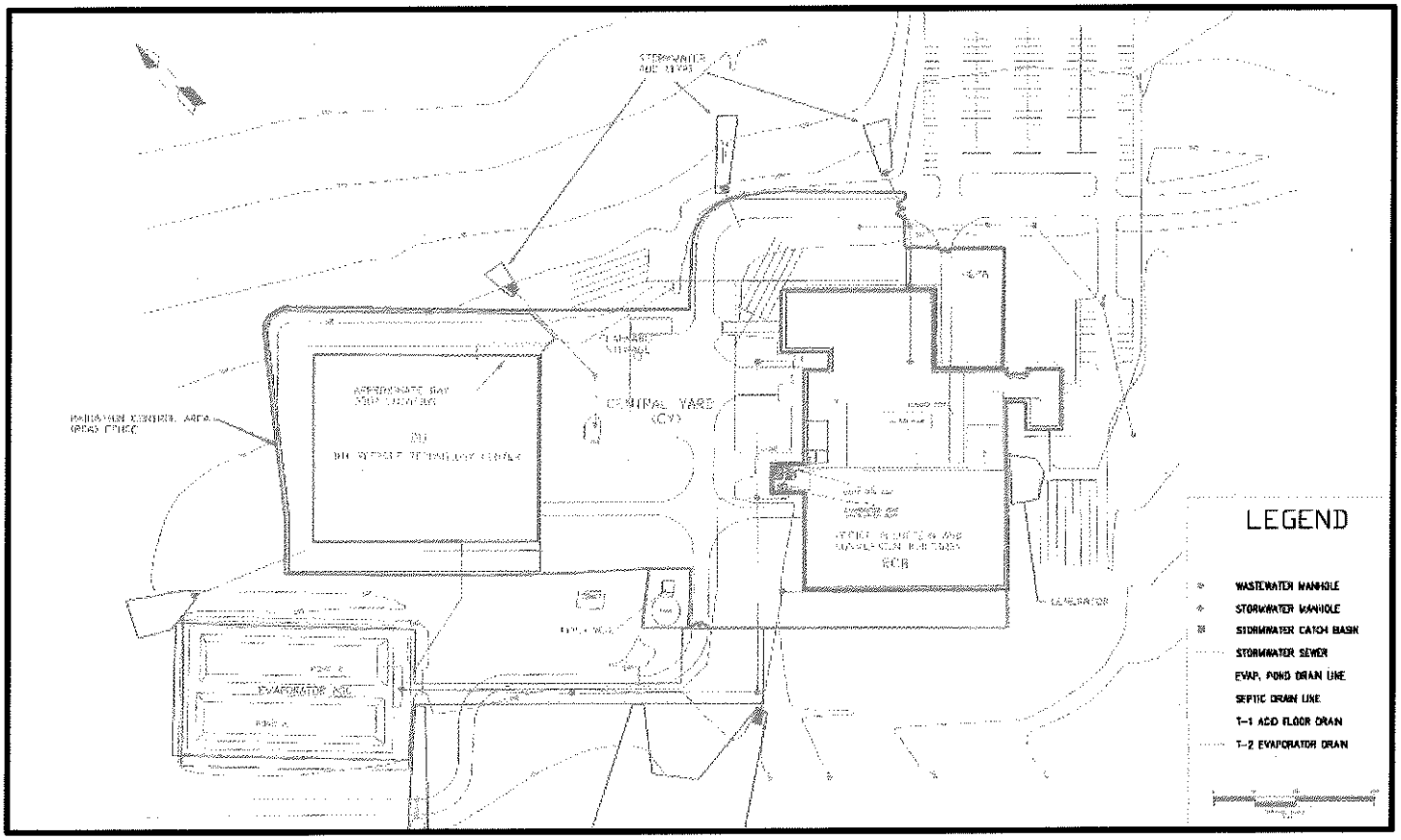
Central Yard Area – The Central Yard Area is the fenced courtyard area between the two main buildings. This area was used both to transport materials between buildings and to store excess containers for which there was no room in either building. Soil in this area is contaminated with uranium.

National Pollutant Discharge Elimination System (NPDES) Stormwater Outfalls – Six outfalls discharge stormwater from the ground surfaces and roof drains to the north, east, and west sides of the facility. Stormwater catch basins draining the Central Yard Area discharge to the northeast. All drainage eventually discharges overland to Gantt's Mill Creek. Soils in these areas are contaminated with uranium.

Atomizer – A wastewater atomizer was installed at the northeast end of the R&C Building in an addition constructed after the original plant was built. The atomizer received and evaporated the most highly contaminated process discharges to produce a solid-phase waste. Air used for evaporation was exhausted after high efficiency particulate air (HEPA) filtration. Soil in this area is contaminated with uranium.

Evaporation Ponds / Process Water Discharge Line – Two lined retention ponds, located near the northwest corner of the DU Building, were in continuous use during the facility's operation to evaporate wastewater from the plant. Although the evaporation ponds were closed during the EPA emergency removal action, soil immediately surrounding the six-inch process water discharge line leading to the ponds was not removed. Soil around this line is contaminated with uranium.

Leach Fields and Septic Tanks – Installed in 1982, and relocated in 1986, a total of four separate septic systems exist on the property. Soils in these areas are contaminated with uranium.



EPA EMERGENCY REMOVAL ACTION

The EPA's ERRB initiated an emergency removal action in July 2002 to immediately prevent the release of depleted uranium from two wastewater retention ponds and to mitigate other risks posed by the Site. At the time of the initial response, the ponds, containing approximately 550,000 gallons of uranium contaminated wastewater, were in danger of overflowing due to heavy rains and an inadequate roof structure covering the ponds. The pond liners were also in poor condition and there were indications the liner system was failing. After treating the wastewater through evaporation and solidification, the remaining solid waste was disposed in the Envirocare Landfill in Clive, Utah.

The many uranium metal processes used over a number of years at the facility created an existing waste inventory that included several million pounds (more than 12,000 drums) of depleted UF_4, approximately 8,700 drums of calcium fluoride and magnesium fluoride, drums of pyrophoric uranium metal shavings, additional uranium metal, dried sludge, and vats of plating acids. To fund the removal of this waste, the EPA ultimately entered into three agreements with five Potentially Responsible Parties (PRPs): the United States Enrichment Corporation (USEC), Cameco Corporation, the United States Department of Energy (DOE), the United States Department of the Army, and Alaron Corporation.

Wastes were shipped from the Site to the Envirocare Landfill (Envirocare) using a truck-rail combination. Once loaded onto flatbed trailers, the packages of waste material were transported seven miles to the Duratek Consolidation Service Facility (DCSF) also located in Barnwell. The DCSF is licensed by the Department to handle low-level radioactive material. From here, the waste material was loaded onto railcars (covered gondolas) and transported to Envirocare.

By 2006, with the exception of counterweights belonging to American Airlines, all other counterweights, free liquids, sludge, slag, Dry Active Waste (DAW), and drummed waste had been removed from the Site. It is also important to note that all EPA activities were conducted with input and oversight of the Department.

SC DHEC INVESTIGATIONS

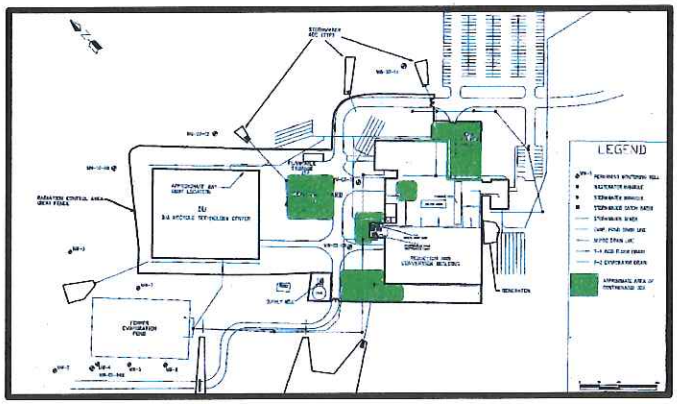
Concurrent with the EPA's removal activities, the Department initiated investigations to determine the nature and extent of residual contamination in soil and groundwater. Data from these investigations is summarized in the following reports:

- Phase I and II Site Investigation Results, STARMET CMI Facility (Earth Tech, Inc, 2002);
- Preliminary Assessment/Site Inspection (SCDHEC, 2003); and
- Draft Site Assessment Report, Former Starmet CMI Site (MACTEC, 2007)

SUMMARY OF SITE RISKS

Soil – As indicated in the data from the soil sampling conducted during the 2007 environmental investigation, there were no concentrations of volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs) that exceeded the US EPA Region IX Residential Preliminary Remediation Goals (PRGs); however, concentrations of several non-radioactive metals (arsenic, iron, and vanadium) did exceed the PRGs. Since the concentrations of arsenic and iron were within the published background concentrations in South Carolina, it is likely these metals are naturally occurring and do not represent a release of these constituents to the environment. Vanadium is often associated with iron in mineral formation, and because there was a correlation between iron concentrations and vanadium concentrations, the elevated vanadium concentrations are likely related to the iron concentrations and thus would also be considered naturally occurring.

In contrast, data collected since 2001 indicates uranium, specifically uranium-238 (U238), has been detected in soils from multiple locations around the Site at levels exceeding 150 picocuries per gram (pCi/g). These locations, indicated below, include the Central Yard, the Evaporation Ponds, around the HEPA Filter Release Area, and beneath the R&C Building.



However, the Evaporation Ponds were stabilized, assessed, and removed by the EPA ERRB in 2002-2003. To confirm this area was adequately remediated, additional soil samples were collected during the 2007 environmental investigation. U238 was not detected in any soil samples collected adjacent to the ponds.

While the Evaporation Pond Area is no longer considered to be a source of U238 contamination at the Site, soils in the Central Yard and HEPA Filter Release Area are continuing sources for U238 contamination.

Groundwater - While there were no concentrations of VOCs or SVOCs that exceeded the South Carolina Maximum Contaminant Levels (MCLs) in groundwater samples collected during the 2007 environmental investigation, concentrations of aluminum and manganese exceeded their respective Secondary MCLs (SMCLs). Since elevated concentrations of these non-radioactive metals in on-Site soils generally appear to be naturally occurring and do not exceed the Residential PRG, the Department has determined that the concentrations of aluminum and manganese in the groundwater beneath the Site are also naturally occurring and do not represent a release of these constituents to the environment.

To confirm groundwater beneath the Evaporation Pond Area had not been impacted, groundwater samples were collected during the 2007 environmental investigation. Elevated levels of U238 were not observed in any of the samples.

Buildings – While the soil sampling results from the 2007 investigation do not indicate the soils beneath the DU Building are impacted by U238, there are isolated areas of surface contamination inside this building.

The R&C Building, due to its age and past use, is highly contaminated on most surfaces excluding the office area. The R&C Building also still contains most of the process equipment used for conversion and production of uranium, almost all of which is contaminated with uranium.

CLEANUP GOALS

Remedial action objectives (RAOs) are developed in order to set goals for protecting human health and the environment. The goals should be as specific as possible, but should not unduly limit the range of remedial alternatives that can be developed. Accordingly, the following RAOs were developed for the Site:

1. Prevent current and future exposure to uranium-238 (U238) in soil at levels in excess of 1.76×10^{-3} pCi/g;
2. Prevent the migration of contamination from impacted soil due to leaching of the contaminants to the groundwater;
3. Prevent current and future exposures to residual uranium contamination on building surfaces at levels exceeding 2000 disintegrations per minute (dpm) per 100 cm^2; and
4. Prevent the migration of uranium from building surfaces at levels exceeding 2000 dpm/100 cm^2 to minimize potential long-term threats.

When determining the cleanup goal for soil, a risk-based preliminary remediation goal (PRG) was calculated using default input parameters and the latest toxicity values based on a target cancer risk of 1×10^{-6} (the risk of one additional occurrence of cancer in one million people). This value was determined to be 1.76×10^{-3} pCi/g.

South Carolina regulations under S.C. Code Ann. Reg. 61-63, 3.57 (RHA 3.57), *Radiological Criteria for License Termination*, do not provide default radiological release limits for real property (buildings) but rather are based on annual dose equivalent. In Section 3.57.2, *Radiological Criteria for Unrestricted Use*, it states, in part:

"A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirem per year, including that from groundwater, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)."

Following RHA 3.57, dose modeling was conducted using the RESRAD computer modeling program to develop Site-specific release limits, identifying the amount of residual radioactive material in the form of U238 which could remain on building surfaces at the Site.

For surfaces in the DU Building, the RESRAD modeling yielded a value of 31,500 dpm/100 cm^2 total uranium to be the unrestricted release limit for total uranium. While this level meets the requirements of RHA 3.57, additional decommissioning would be required if the structure is demolished at a later date since decommissioning activities involving structures and equipment could achieve removable contamination limits of ≤2000 dpm/100 cm^2. Since the DU Building is considered valuable for re-use, it is a good candidate for decontamination to unrestricted release limits as these levels are more conservative and would eliminate the need for any potential future remediation or deed restrictions.

Decontamination and release of the R&C Building is not feasible due to several factors, including the age and condition of the building making it unsuitable for future use and the high levels of contamination inside the building and on equipment inside the building.

SCOPE AND ROLE OF THE ACTION

The proposed action in this Proposed Plan will be the final cleanup action for the Site. The remedial action objectives for this proposed action include preventing exposure to contaminated soils and building surfaces and preventing the migration of contaminants farther into the environment.

It is apparent from past and recent radiological sampling and characterization events that the uranium at the site has not migrated, and is not migrating, far into the environment. As long as the integrity of the R&C Building is maintained, this should not change. However, any major event such as a hurricane or fire that breaches the building has the potential to spread uranium well beyond the property boundary in amounts that could significantly impact the surrounding environment and nearby residents.

The proposed response action identified in this Proposed Plan will permanently reduce the toxicity, mobility, and volume of contamination at the Site.

SUMMARY OF REMEDIAL ALTERNATIVES

Based on information collected during previous investigations, *an Evaluation of Remedial Options* (MACTEC, 2008) was conducted to identify, develop, and evaluate options and remedial alternatives to address the contamination at the Site. This evaluation considered the nature and extent of contamination and associated potential human health risks developed during the remedial investigations and associated studies to determine and evaluate potential remedial alternatives and their overall protection of human health and the environment. Costs associated with the implementation of each alternative were updated in the *Revised Decommissioning Cost Estimate Report* (AMEC, 2014) and *Revised Appendix A1* (Amec Foster Wheeler, 2015). Each remedial alternative evaluated by the Department is described briefly below. Note: A final Remedial Design will be developed prior to implementation of any alternative.

SUMMARY OF REMEDIAL ALTERNATIVES

Alternative	Description
1: No Action	• Site vacated in current condition • Cessation of security, radiation protection, and maintenance • Net present worth: $0
2: Site Maintenance	• Engineering controls: fences, locked gates, 24-hour security system • Provision for on-Site Radiation Safety Officer (RSO) to provide security, monitoring, emergency response, radiation protection, water management, upkeep of ventilation system and utilities, facility repairs, and other maintenance-related waste management activities • Net present worth: Approximately $6.27M (total cost over fifty years of approximately $27.6M)
3: Unrestricted Release	• Decontamination of the DU Building for future use without restrictions • Demolition and removal of the entire R&C Building and its contents • Remediation of uranium contaminated soils in the following areas: Central Yard, HEPA Filter Release Area, beneath the R&C Building, around all septic systems, along all sanitary sewer lines, and along the process water discharge line • Off-site disposal of all contaminated materials at an appropriately-licensed facility • Demonstration that applicable release limits (concentrations) have been met by conducting a final comprehensive radiological survey (Final Status Survey) • Net present worth: Approximately $35M (one time cost)

DESCRIPTION OF ALTERNATIVES

Alternative 1 - No Action

The No Action alternative is required by the National Contingency Plan to be carried through the screening process, as it serves as a baseline for comparison of the other remedial action alternatives.

The No Action alternative consists of leaving the Site in its current condition. The security, radiation protection, and maintenance currently provided by the Department would cease. No remedial activities would be implemented, and the long-term human health and environmental risk would exist indefinitely into the future. This alternative provides no control of exposure to workers, the community, and the environment to contaminated soil and no reduction in risk to human health. Additional releases of contaminated media will likely occur as the facility structures deteriorate over time.

Since the Site is subject to a South Carolina Radioactive Materials license, and therefore subject to the license termination requirements in RHA 3.57, the Applicable or Relevant and Appropriate Requirement (ARAR) for unrestricted release is 25 millirem per year (mrem/y). Since no action would be taken under this alternative, the radioactive materials license would be terminated. Consequently, the No Action alternative would not meet the state's regulatory requirements.

The No Action alternative includes no controls for exposure and no long-term management measures. All current and potential future risks would remain under this alternative as there would be no reduction in toxicity, mobility, or volume of contaminated material through either treatment or removal.

Additional risk would be posed to the community, workers, and the environment as a result of the No Action alternative being implemented. There would be no security or radiation protection in

place and access to the Site would be unrestricted resulting in exposure to the community or workers. There would be no operations and maintenance of the facility and the deterioration of the R&C Building would likely result in the migration of radioactive materials to the environment.

Since no action would be taken under this alternative, there are no implementability concerns and no cost incurred.

Alternative 2 – Site Maintenance

The Site Maintenance alternative consists of providing engineering controls to limit exposure of contaminants and additional releases of contaminated media from any building on the property. This alternative includes security, monitoring, emergency response, radiation protection, water management, operation of ventilation units and utilities, facility repairs, and other operations and maintenance-related waste management activities for an undetermined length of time. For the purpose of this evaluation, the cost of maintaining the facility under the Site Maintenance alternative has been considered for a 50-year period.

It must be noted that even though a 50-year period has been considered for this analysis, Site maintenance would be required far beyond 50 years due to the extremely long radioactive half-life of U238 (4.51 billion years), or a different alternative would be required during, or at the end of, the 50-year period.

The Site Maintenance alternative is not subject to the ARAR of 25 mrem/y because the Site's radioactive materials license would remain in effect. Ongoing maintenance activities would require compliance with the license and associated South Carolina regulations.

While this alternative does include controls for exposure to contaminated soil to the community (including trespassers) through the existence of fences, locked gates, a 24-hour security system, and the presence of a Radiation Safety Officer at the facility, there is no reduction in risk to human health or the environment. Long-term management measures would continue to operate under the Department-approved Operations and Maintenance (O&M) Plan. All current and potential future risks would remain under this alternative as there would be no reduction in toxicity, mobility, or volume of contaminated material through treatment or removal.

Minimal additional risk would be posed to the community, workers, or the environment as a result of the implementation of the Site Maintenance alternative. Site security and radiation protection would minimize the risk to the community. Although there would be a small incremental risk to Site workers, proper training and radiological protection would minimize exposure to radiological contamination. The risk of exposure to the environment beyond the current Site boundaries associated with potential fire, flood (from a roof collapse), and building deterioration would be minimized through the continued maintenance and repair of the facility.

Since a Department-approved O&M Plan is currently in effect and the existing radiological monitoring system will provide notice of failure before significant exposure occurs, the Site Maintenance alternative has no implementability concerns. However, the primary concern regarding the facility is the on-going degradation of the R&C Building, which will continue to worsen under this alternative.

The net present worth of this alternative is $6,272,228. Through the year 2063, this alternative is estimated to cost a total of $27,619,467 to implement (*Revised Appendix A1, Evaluation of Remedial Options*, Amec Foster Wheeler, May 2015). This estimate includes the 2014 O&M costs increased at 3% per year to reflect future inflation and capital costs to replace the roofs on the two buildings twice during the 50-year period. As stated earlier, due to the very long radioactive half-life of U238, this alternative would not provide permanent resolution at the end of the 50-year period. Site maintenance would either need to be continued far beyond 50 years or a different alternative would need to be undertaken at that time.

Alternative 3 - Released for Unrestricted Use (Unrestricted Release)

The presumptive remedy of Unrestricted Release has been proposed to accelerate the remedial process at the Site. This remedy was evaluated as there is no established remedial alternative for treating the radiological contamination in place and due to the nature of the radiological contamination, containment methodologies are not considered to be appropriate.

While the term "unrestricted use" is not specifically defined in South Carolina regulation, RHA 3.57 provides insight as to the intended meaning. Unrestricted use is understood to be the time when a site (or facility) has been released from any and all institutional controls. The site is safe such that it may be used, developed, re-developed, occupied, etc. without restriction due to residual radioactive material. At this point, the site's radioactive material license can be terminated as it is no longer warranted.

This alternative consists of decontamination of the DU Building, demolition of the entire R&C Building and its contents, off-site disposal of all contaminated debris, and remediation of the aforementioned contaminated land areas containing concentrations of uranium above the previously discussed remediation goals.

While this alternative carries a small incremental risk to the workforce needed to accomplish the decontamination and decommissioning (D&D) activities necessary for unrestricted release, once completed, there is a permanent reduction in the long-term risk to workers, the public, and the environment. The small incremental short-term risk for remediation workers is greatly offset by the long-term reduction in risk to all other groups.

Prior to any Site activities, a comprehensive Decommissioning Plan would be developed and submitted to the Department. Once approved, decommissioning-specific safety, radiation protection, and environmental procedures would be developed. Physical decommissioning of the R&C Building would be initiated by the removal of contaminated equipment, piping, systems, tanks, etc. from inside the building. The building itself would then be demolished, including below-grade structures, footers, and utilities. Soils under and around the R&C Building would also be remediated through removal. Once the radioactive contaminated debris is size-reduced, it would be packaged and transported (via truck and rail) to a licensed Low Level Radioactive Waste (LLRW) site. After all waste shipments have been performed, a Final Status Survey of the remaining building and land areas would be conducted to ensure the complete removal of contaminated material.

Site decommissioning activities, including waste packaging, transportation, and disposal are subject to South Carolina radioactive material regulations. Such activities would be accomplished in compliance with a radioactive materials license issued by the State of South Carolina.

While the Unrestricted Release alternative would entail a significant effort by qualified remediation contractors in the short-term, the methodologies and procedures to implement the alternative are well understood and should not provide any barriers to the effective completion of the alternative.

Although this alternative requires a large capital investment to implement, there is no need for any type of long-term funding. The net present worth of the Unrestricted Release alternative is estimated to be $35,006,996 (Revised Decommissioning Cost Estimate Report, AMEC, May 2014).

EVALUATION OF ALTERNATIVES

The National Contingency Plan requires the Department use specific criteria to evaluate and compare the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan profiles the relative performance of each alternative against the criteria, noting how it compares to the other options under consideration. The criteria are:

1. Overall protection of human health and the environment;
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness;
6. Implementability;
7. Cost; and
8. Community acceptance

The main objectives for the preferred remedial action are to be protective of human health and the environment and to comply with State and Federal regulations. These two objectives are considered *threshold criteria*. Threshold criteria are requirements each alternative must meet in order to be eligible for selection. For an alternative to be considered as final, these two threshold criteria must be met. The Department's remedial action must be protective of human health and the environment and comply with State and Federal standards.

The following measures are considered *balancing criteria*: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. These criteria are used to weigh the technical feasibility, strengths and weaknesses, and cost advantages and disadvantages of each alternative.

Community response to the preferred alternative and the other considered alternatives is a *modifying criterion* that will be carefully considered by the Department prior to final remedy selection.

COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of each alternative was performed. In this type of analysis, the alternatives were evaluated in relation to one another for each of the evaluation criteria. The purpose of the analysis is to identify the relative advantages and disadvantages of each alternative.

Note: Although Alternative 1 (No Action) does not meet the threshold criteria, it is retained for discussion because it provides a baseline for comparing the other alternatives to the criteria outlined above.

Overall Protection of Human Health and the Environment

When evaluating alternatives in terms of overall protection of human health and the environment, consideration is given to the manner in which Site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

The No Action alternative does not provide adequate protection of human health and the environment. Since this alternative does not meet this threshold criterion, it has been eliminated from consideration as a response action and, as stated earlier, only retained for discussion because it provides a baseline for comparing the other alternatives to the balancing criteria.

Provided the R&C Building can be maintained, the Site Maintenance alternative will provide adequate protection of human health; however, this protection is not guaranteed as the structural integrity of the R&C Building is compromised, will continue to degrade, and cannot be maintained indefinitely.

The Unrestricted Release alternative is the only alternative which provides protection to both human health and the environment.

Compliance with ARARs (Applicable or Relevant and Appropriate Requirements)

This evaluation criterion evaluates whether an alternative meets federal and state environmental statutes and regulations that pertain to the Site. Each alternative is evaluated with respect to its ability to comply with such requirements.

ARARs are used to determine the appropriate extent of cleanup, to scope and formulate the remedial action alternatives, and to govern the implementation and operation of the selected remedy. Applicable requirements are those legally enforceable standards that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance encountered at a site. Relevant and appropriate requirements are federal or state standards, criteria, or limitations that, while not legally applicable to a site, address problems sufficiently similar to those found so their use is well-suited to a particular site.

The No Action alternative does not meet applicable South Carolina regulations. Again, since this alternative does not meet a threshold criterion, it has been eliminated from consideration as a response action and only retained for discussion because it provides a baseline for comparing the other alternatives to the balancing criteria.

Once the Site's Radioactive Materials license is terminated, the No Action alternative would not protect against radiological exposure and thus, would not comply with the allowable residual radioactivity TEDE of 25 mrem/yr allowed under RHA 3.57; however, the Unrestricted Release alternative will meet this allowable dose limit. This limit is not applicable to the Site Maintenance alternative because the Site's radiological license would remain in effect.

Long-Term Effectiveness and Permanence

The magnitude of residual risk remaining from untreated impacted media or treatment residuals and the adequacy and reliability of containment systems and institutional controls are evaluated under this criterion.

The No Action alternative includes no controls for exposure and no long-term management measures. All current and potential future risks would remain under this alternative.

The Site Maintenance alternative leaves the contaminated material in place and relies upon engineering controls to prevent exposure; however, the long-term effectiveness is mitigated by the potential deterioration of the facility.

The Unrestricted Release alternative provides the highest degrees of long-term effectiveness and permanence because this alternative removes all contaminated soil and buildings from the Site.

Reduction of Toxicity, Mobility, or Volume through Treatment

The degree to which an alternative employs treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present is evaluated by this criterion.

Neither the No Action nor Site Maintenance alternatives would provide any reduction of toxicity, mobility, or volume of contaminated media. Although the Unrestricted Release alternative uses no treatment technologies, all contaminated soil and building materials would be excavated, demolished, and removed from the Site for disposal, ultimately effecting a reduction of toxicity, mobility, and volume.

Short-Term Effectiveness

The short-term effectiveness evaluation takes into consideration any risk the alternative poses to on-Site workers, the surrounding community, or the environment during implementation, as well as the length of time needed to implement the alternative.

Implementation of the No Action alternative would pose additional risk to the community, workers, and the environment in the short-term since there would be no security or radiation protection. Access to the site would also be unrestricted resulting in potential exposure to potential trespassers. Since there would be no operations and maintenance, the continued deterioration of the R&C Building would likely result (more quickly through fire or adverse weather conditions) in the migration of radioactive materials to the environment.

Due to engineering controls, the short-term effectiveness of the Site Maintenance alternative reduces risk to workers (through training) and the community (through fencing and security) but does not prevent short-term risk to the environment.

The Unrestricted Release alternative is anticipated to have the greatest short-term effectiveness and presents the lowest cumulative risk to workers, the community, and the environment. Some particulate emissions from demolition and excavation activities are anticipated during implementation of the remedy; however, dust control methods should minimize the risk.

Implementability

The analysis of implementability considers the technical and administrative feasibility of remedy implementation, as well as the availability of required materials and services.

Other than the No Action alternative, the Site Maintenance alternative would be the easiest alternative to implement since a Department-approved O&M Plan is already in effect. However, this alternative would be required to be implemented indefinitely. The Unrestricted Release alternative would entail a significant effort by qualified contractors in the short-term, but the methodologies and procedures to implement the alternative are well understood and should not provide any barriers to the effective completion of the alternative.

Cost

The cost criterion includes estimated initial capital costs and annual O&M costs, as well as a present worth cost evaluation. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of -30% to +50%.

There is no cost associated with the No Action alternative.

The Site Maintenance alternative net present worth of $6.27M is lower than the Unrestricted Release alternative net present worth of $35M. Although the Unrestricted Release alternative requires a large investment to implement, there is no need for any type of long-term funding; unlike the Site Maintenance alternative where funding is incremental on an annual basis.

Even though a 50-year period has been proposed for implementation of the Site Maintenance alternative, such maintenance would be required far beyond 50 years due to the extremely long radioactive half-life of U238 (4.51 billion years), or a different alternative would be required during, or at the end of, the 50-year period.

Community Acceptance

Community acceptance of the preferred remedy will be evaluated after the public comment period. Public comments will be summarized and responses provided in the Responsiveness Summary Section of the Record of Decision document that will present the Department's final alternative selection. The Department may choose to modify the preferred alternative or select another remedy based on public comments or new information.

SUMMARY OF THE DEPARTMENT'S PREFERRED ALTERNATIVE

The Department has identified a preferred alternative to address the radiological contamination in both the soil and buildings at the Site. This preferred remedial alternative, Unrestricted Release (Alternative 3), consists of the following components:

- Decontamination of the DU Building for future use without restrictions;
- Demolition and removal of the entire R&C Building and its contents;
- Remediation of uranium contaminated soils in the following areas: Central Yard, HEPA Filter Release Area, beneath the R&C Building, around all septic systems, along all sanitary sewer lines, and along the process water discharge line;
- Off-site disposal of all contaminated materials at an appropriately-licensed facility; and
- Demonstration that applicable release limits (concentrations) have been met by conducting a final comprehensive radiological survey (Final Status Survey).

The total estimated net present worth of this alternative is approximately $35M.

The presumptive remedy of Unrestricted Release has been proposed to accelerate the remedial process at the Site. This remedy was evaluated as there is no established remedial alternative for treating the radiological contamination in place and due to the nature of the radiological contamination, containment methodologies are not considered to be appropriate.

Prior to any Site activities, a comprehensive Decommissioning Plan would be developed and submitted to the Department. Once approved, decommissioning-specific safety, radiation protection, and environmental procedures would be developed. Physical decommissioning of the R&C Building would be initiated by the removal of contaminated equipment, piping, systems, tanks, etc. from inside the building. The building itself would then be demolished, including below-grade structures, footers, and utilities. Soils under and around the R&C Building would also be remediated through removal. Once the radioactive contaminated debris is size-reduced, it would be packaged and transported (via truck and rail) to a licensed Low Level Radioactive Waste (LLRW) site. After all waste shipments have been performed, a Final Status Survey of the remaining building and land areas would be conducted to ensure the complete removal of contaminated material.

Unrestricted release of the Site would allow the property to be used, developed, re-developed, occupied, etc. without restriction due to residual radioactive material. At this point, the Site's Radioactive Materials license would no longer be necessary and could be terminated.

Although this alternative carries a small incremental risk to the workforce needed to accomplish the D&D activities, it significantly reduces the risk to workers, the public, and the environment once the Site is released from radiological controls. It is important to note that all decommissioning activities would be accomplished in compliance with a radioactive materials license issued by the State of South Carolina.

Based on information currently available, it is the Department's judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health and the environment.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Former Starmet CMI Facility (Starmet) Site is important. Comments provided by the public are valuable in helping DHEC select a final cleanup remedy.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by **February 27, 2017**. If you have any questions, please contact Angie Jones at 803-898-0769. You may also submit your questions and/or comments electronically to: jonesar@dhec.sc.gov.

Name _____ Telephone _____

Address _____ Email _____

City _____

State _____ Zip _____